Job Loss Analysis

Control No: 2000143________ **Status:** closed____________ **Original Date:** 26 May 2010

Last Date Closed: 09/09/2010______

Organization: GMFG

JLA Type: Global Manufacturing Shared_______________________________________

Work Type: Technical Process Engineering____

Work Activity: Heat Exchanger Monitoring

Personal Protective Equipment (PPE)

☐ Goggles	☐ Hearing Protection	☐ Warning Device	☐ Gloves(Nitrile, rubber, leather)
☐ Face Shields	☐ Hard Hat	☐ Tagout/Lockout kit	☐ Other
☐ Safety Glasses	☐ Safety Shoes	☐ Hi Viz Jacket	☐ Other ___________________
☐ Safety Back Belt	☐ Safety Cones	☐ Welding Hood	☐ Other ___________________

Reviewers

Reviewer Name	Position	Date Approved
Michelle Johansen	Process Engineering Manger	09/09/2010
Aaron Sims	Lead Engineer	09/09/2010
Brad Moore	Lead Engineer	09/09/2010

Development Team

Development Team Member Name	Primary Contact	Position
Charles Odumah	CTN 242-1114	Process Engineer
Christopher Robinson	CTN 242 3617	Process Engineer
Brad Moore	CTN 938-4367	Process Engineer
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Steve Leichty	303 440-5321	Global Mfg Process Monitoring Specialist
Tin Yin Lam	CTN 615-5715	Global Mfg Heat Exchanger Specialist

Job Steps

No.	Job Steps	Potential Hazard	Critical Actions
1.	Identify the critical heat exchangers (HEX) to monitor in the plant and the frequency for monitoring. Critical exchangers are defined as heat exchangers that are subject to known fouling or corrosion mechanisms as defined by the appropriate BIN Leader or those that have a history of chronic fouling, corrosion, leaks, or otherwise poor performance.	1. Increased energy consumption, unplanned plant slowdown or shutdown, or missed opportunity to modify and improve a poor HEX design prior to a planned turnaround (LPOs).	1a. Consult with BIN Leader on the unit 1b. Review inspection records, datasheets, vendor HEX drawings, and SIS. 1c. Consult with Operations and Reliability personnel 1d. Review past turnaround reports for exchanger findings and recommendations.
2.	Determine in place instrumentation and monitoring variables/tools for plant critical HEX. The following is required for accurate monitoring. 1. Shell side flow meter 2. Tube side flow meter 3. Shell side inlet TI 4. Shell side outlet TI 5. Tube side inlet TI 6. Tube side outlet TI 7. Inlet tube PI 8. Outlet tube PI 9. Inlet Shell PI (useful if fouling side in on shell- example salt build-up) 10. Outlet Shell PI (useful if fouling side in on shell- example salt build-up) 11. For cooling water HEX, monitor the cooling water velocity.	1. Insufficient monitoring tools can lead to not recognizing fouling or plugging of a HEX 2. Inaccurate instruments and/or a lack of indicating instruments can lead to an inaccurate heat balance, high dp, or misunderstood fouling or plugging of a HEX. 3. If cooling water velocities are too low, scaling can develop, resulting in delineated performance and/or plugging	1.Use PMO (Process Monitoring Optimization) or other monitoring tool to track heat exchanger performance (U values/DP/etc). 2a. Determine if adequate instrumentation exists for daily monitoring of each critical HEX by reviewing P&IDs and current monitoring tools like PMO. If not, the missing instrumentation should be added to the unit's shutdown recommendations checklist. 2b. Conduct a field walk of the heat exchanger to check field instrumentation locations and assure it is in the right locations for monitoring. Field readings may have to be added to monitoring. 3. Ensure cooling water velocities are tracked and kept within limits.
3.	Check the accuracy of the flow and temperature instrumentation. • If all temperatures and flows are available, compare the shell side and tube side heat duties. For exchangers with 2-phase flows and with phase change (reboilers and condensers), modeling tools such as Hysys and Pro/II can be used. • Validate flow meter readings • Validate temperature indicator readings	1. Inaccurate instruments can lead to an inaccurate heat balance and erroneous performance calculations. 2. Possible increase in erosion/corrosion if exchanger flow velocities are exceeded.	1a. Ensure all TI's are working properly. In some cases this may require field verification with a temperature gun or dial temperature gauge 1b. Validate flow meter readings from plant mass and energy balance. In some cases, a strap on flow meter can be used 1c. Repair or calibrate flow and instrumentation to ensure data accuracy. 1d. Monitor air and water temperatures when needed for fin fans or cooling water exchangers.

No.	Job Steps	Potential Hazard	Critical Actions
			2. Calculate flow velocities using PE tools or other engineering program.
4.	Obtain 5 to 10 years worth of temperature, flow, and lab data and calculate fouling factors/U values for HEX.	1. Loading only one year in a PMO/monitoring tool does not allow for observation of performance over the long term or since it was last retubed/cleaned.	1a. Trend back all the available data 5 to 10 years and calculate HEX parameters such as fouling factor and U value 1b. Review the 5 to 10 year heat exchanger data with a specialist to ensure the right trends are being viewed 1c. Consider using HTRI or PETools HEXMON functions for HEX calculations
5.	Calculate Heat Exchanger DP and normalized DP for plant critical HEX. Note –HEX with only field PIs should have frequent DP surveys done.	1. Plugging of the HEX or plant slowdown or shutdown (LPO).	1a. Ensure HEX DP calculation for critical plant HEX is in plant PMO or other monitoring tool. 1b. Verify normalized DP calculation with Chevron Heat Exchanger subject matter expert. 1c. Groups of exchangers may be monitored together if DP's are not available for each critical exchanger 1d. Add Field readings to PMO or other monitoring tools to assure they get taken.
6.	If heat transfer rate and fouling factor cannot be calculated due to insufficient process data; monitor inlet, outlet temperatures and Differential Temperature (DT) for critical plant HEX	1. Possibility of exceeding HEX metallurgy limit that can lead to equipment failure. 2. Maximum allowable temperature rise across HEX resulting in mechanical damage. 3. Flow in HEX not in required flow regime resulting in mechanical damage to exchanger. 4. Possible fouling of the HEX	1. Ensure inlet and outlet temperatures of critical HEX are monitored in the PMO. 2. Ensure operation within the correct temperature operating window. 3. Ensure HEX DT calculation for critical plant HEX is in plant PMO and verify DT calculations with Supervisor/SME. 4. Plan ahead for possible HEX (especially fin fans) cleaning during peak load seasons.
7.	Evaluate post turnaround cleaning performance of HEX and report results.	1. Cleaning method may not be working (hydroblast vs. chemical wash) or cleaning doesn't improve heat transfer 2. Post cleaning data and economics are not saved for future decisions resulting in lost time or missed	1a. Review all post cleaning data to determine effect on HEX performance. 1b.Recommend changes to cleaning procedures or possible redesign of HEX. 2.Write up summary report on HEX data and save on GDW or local Process Engineering

No.	Job Steps	Potential Hazard	Critical Actions
		opportunities.	folder.